

03-27-00

A

Please type a plus sign (+) inside this box → ☐PTO/SB/05 (4/98)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.UTILITY
PATENT APPLICATION
TRANSMITTAL

Attorney Docket No. NORTH-391A/A-2244

First Inventor or Application Identifier Shannon M. Nelson et al.

Title SHOCK-RESISTANT BACKPLANE UTILIZING...

Express Mail Label No. EL482797695US

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231jc135 U.S. PTO
09/534880

03/24/00

1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 15]
(preferred arrangement set forth below)
- Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 2]
4. Oath or Declaration [Total Pages 21]
- a. ☒ Newly executed (original or copy)
- b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
- i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
- a. ☐ Computer Readable Copy
- b. ☐ Paper Copy (identical to computer copy)
- c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☒ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney (when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 [Copies of IDS Citations]
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ * Small Entity Statement(s) filed in prior application, Status still proper and desired (PTO/SB/09-12)
14. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
15. ☐ Other:

* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____

Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label (Insert Customer No. or Attach bar code label here) or ☐ Correspondence address below

Name	Terry J. Anderson				
	NORTHROP GRUMMAN CORPORATION				
Address	1840 Century Park East				
City	Los Angeles	State	CA	Zip Code	90067-2199
Country	U.S.A.	Telephone	(310) 332-5666	Fax	(310) 332-5678

Name (Pnn/Type)	Bruce B. Brunda	Registration No. (Attorney/Agent)	28,497
Signature	<i>Bruce B. Brunda</i>	Date	3/24/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

Case No.: NORTH-391A/A-2244

SHOCK-RESISTANT BACKPLANE UTILIZING INFRARED COMMUNICATION
5 SCHEME WITH ELECTRICAL INTERFACE FOR EMBEDDED SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATIONS
(Not Applicable)

10 STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT
(Not Applicable)

BACKGROUND OF THE INVENTION

Embedded or enclosed systems for housing electronic
15 components, such as a computer chassis, that are designed
to withstand high shock and vibration are well-known in the
art. Exemplary of such prior-art enclosures include those
environmental enclosures disclosed in United States Patent
Nos. 5,309,315 and 5,570,270, issued on May 3, 1994 and
20 October 29, 1996, respectively, to Nadell et al., entitled
SEVERE ENVIRONMENT ENCLOSURE WITH THERMAL HEAT SINK AND EMI
PROTECTION, the teachings of which are expressly
incorporated herein by reference. Additionally exemplary
of such prior-art apparatus include those enclosures
25 disclosed in United States Patent No. 5,381,314 issued on
January 10, 1995 to Rudy, Jr. et al., entitled HEAT
DISSIPATING EMI/RFI PROTECTIVE FUNCTION BOX, the teachings
of which are likewise incorporated herein by reference.

In this regard, such devices are typically designed to
30 house computer systems for use in predominantly embedded
applications in severe environments. With respect to the
latter, it is well-recognized in the art that a severe
environment is generally defined as one subject to large
environmental extremes due to temperature, humidity,
35 radiation, electromagnetic induction, shock and vibration.

Additionally, an embedded application is generally accepted as meaning a specific function or functions, which are contained within a larger application, and requires no human intervention beyond supplying power to the computer.

5 Exemplary of such embedded applications include systems and process controls, communications, navigations, and surveillance.

10 In order to properly function and perform such applications, it is critical that the computer and other electronic components housed within such enclosures be constructed, supported and enclosed in such a way as to be able to withstand such severe conditions. Along these lines, the primary focus of such prior-art enclosures is to provide a structurally sound enclosure for an array of
15 individual circuit boards or daughter cards in a backplane assembly to which the circuit boards are electrically connectable and disconnectable, to thus define a card cage.

20 Despite the best efforts that can be made with respect to properly arranging such circuit cards, however, an inherent problem in all such embedded systems arises from the use of wiring between circuit cards, which is necessary to interconnect such circuit cards for data transfer. Specifically, hard-wired connections are known to become disconnected when subjected to extremes in shock and
25 vibration. In addition, because most prior art backplanes incorporate the use of a plurality of pins to transmit data between modules, there is thus increased the potential for electrical connections to disconnect after repeated impact. Also, the use of a plurality of pins can lead to an
30 increase in energy consumed.

As such, there is a substantial need in the art for a system and method for operatively interconnecting a plurality of circuit cards with one another within an embedded system that can withstand severe environments to
35 a greater degree than prior art system and methods.

Likewise, there is a substantial need in the art for such systems and methods that can produce greater reliability, can be implemented utilizing existing technology, and allows for substantially more simplified circuitry design
5 than prior art systems and methods.

BRIEF SUMMARY OF THE INVENTION

The present invention specifically addresses and alleviates the above-identified deficiencies in the art.
10 In this regard, the present invention is directed to systems and methods for interconnecting a plurality of modules, namely circuit boards or daughter cards, in an embedded environment that have increased reliability, can withstand shock and vibration, and provide greater
15 electrical isolation between such modules than prior art methods and systems.

In a preferred embodiment, the system comprises the use of a standardized infrared communication scheme, and in particular one or more schemes developed by the Infrared
20 Data Association, or IrDA, having an electrical interface to transmit and receive data between modules. In this regard, each respective one of the plurality of modules comprising an embedded computer system is provided with an IrDA electrical interface to transmit and receive signals
25 to thus provide a connection between such modules.

Using an electrical interface implementation of IrDA provides for more secure interconnection between modules than prior art hard-wiring techniques, and further increases reliability by providing greater redundancy
30 (i.e., increasing the number of conductors used and available for transmitting the same data over multiple wires). The IrDA with an electrical interface additionally provides for more secure interconnection than conventional IrDA schemes by eliminating the need for line-of-sight
35 necessary for signals to be properly transported from a

transmitter, typically an LED, to a receiver, the latter typically a photodiode. The electrical interface further minimizes power consumption by eliminating both the photodiode transceiver and LED components typically incorporated in most conventional IrDA schemes. Moreover, by utilizing infrared communication schemes, the systems and methods of the present invention can transmit data at high speed, which are currently known in the art to function at 4 Mbps, and may eventually exceed 16 Mbps.

It is therefore an object of the present invention to provide a system and method for electrically interconnecting a plurality of circuit cards with one another within an embedded system that can withstand severe environments to a greater degree than prior art system and methods.

Another object of the present invention is to provide a system and method for operatively interconnecting a plurality of circuit cards with one another with an embedded system that, in addition to being able to withstand severe environmental conditions, further minimizes power consumption.

Another object of the present invention is to provide a system and method for operatively interconnecting a plurality of circuit cards with one another within an embedded system that has greater reliability than prior-art systems and methods, particularly with respect to performing data transfer functions.

Another object of the present invention is to provide a system and method for operatively interconnecting a plurality of circuit cards with one another within an embedded system that are operative to facilitate high speed communication between system modules or circuit cards contained within such system.

Still further objects of the present invention are to provide a system and method for operatively interconnecting

5 a plurality of circuit cards with one another within an embedded system that is of simple and durable construction, relatively inexpensive to design and fabricate, may be readily designed and implemented using conventional technology, and is more effective and efficient than prior art systems and methods.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

10 These, as well as other features of the present invention, will become more apparent upon reference to the drawings, wherein:

Fig. 1 is an exploded view of an enclosure depicting a circuit card positionable therewithin.

15 Fig. 2 depicts a traditional IrDA setup that enables data to be transmitted and received between two modules via a transmission medium of air.

20 Fig. 3 is block diagram of a proposed electrical interface implementation of IrDA between two respective modules of an embedded computer system that enables data to be transmitted and received therebetween.

Fig. 4 is a block diagram of a second proposed electrical interface implementation of IrDA between two respective modules of an embedded computer system that enables data to be transmitted and received therebetween.

25

DETAILED DESCRIPTION OF THE PRESENT EMBODIMENT

30 The detailed description as set forth below in connection with the appended drawings is intended as a description of the presently preferred embodiments of the invention, and is not intended to represent the only form in which the present invention may be constructed or utilized. The description sets forth the functions and sequences of steps for constructing and operating the invention in connection with the illustrated embodiments.

35 It is understood, however, that the same or equivalent

functions and sequences may be accomplished by different embodiments and that they are also intended to be encompassed within the scope of this invention.

Referring now to the figures, initially to Fig. 1, there is shown an exploded view of an environment enclosure 10 for housing a computer system for use in running embedded applications in severe environments. As is well-known to those skilled in the art, such enclosures 10 are capable of withstanding extreme environmental conditions, such as maximum extremes of shock, vibration, temperature, EMI, humidity, as well as sand, dust, and the like. Such containers are particularly effective in running embedded applications, which are defined as a specific function which is contained within a larger application requiring no human intervention beyond supplying power to the computer (not shown) housed therewithin. For example, embedded applications include but not limited to, systems and process control, communications, navigation, and surveillance.

The computer systems utilized to run such application typically comprise a plurality of circuit boards or daughter cards, such as 12, that are affixed about a backplane 16 rigidly mounted within the enclosure. In this respect, the backplane is provided with a plurality of connectors 18 for supporting a plurality of circuit cards in generally parallel, upright relationship. The backplane 16 also supports the power supply (not shown), which is typically located within such enclosure 10, to thus provide power for the computer system to function.

In prior art systems, the circuit cards are typically hard wired to one another, typically through a large number of conductors or pins, to enable data to be transmitted and received therebetween. The use of hard-wire electric connections, however, is known to have several drawbacks. In this regard, hard wiring is known to be unreliable,

particularly when subjected to severe shock and vibration insofar as such forces cause the wire connections between circuit cards to break.

To address such problems, there is provided herein a novel communications scheme by which circuit cards can be interconnected to one another to transmit and receive data that eliminates the foregoing drawbacks. In this respect, there is provided herein an infrared communications scheme utilizing an electrical interface that interconnects the plurality of circuit cards of an embedded computer system to thus enable data to be received and transmitted therebetween. In this respect, each respective one of the plurality of the circuit cards is provided with a dedicated pair of buffered digital transceivers electrically connected to one another that enable data signals to be transmitted and received therebetween.

The infrared communications scheme utilized in the present invention may take any of a variety of the standard infrared protocols developed by the Infrared Data Association, also known as IrDA. As is well-known to those skilled in the art, the IrDA has created interoperable, low-cost infrared data interconnection standards that support a broad range of applications for use in computing and communications devices. A traditional IrDA setup is depicted in Fig. 2 which, in simplified form, illustrates the ability to transmit and receive data between modules, via an air medium. As illustrated, a first module A, referred to as 20, is provided with an LED 22 for transmitting optical signals and a photodiode 24 for receiving optical signals. A second module B, referred to as 26, is provided that likewise has an LED 28 and photodiode 30 formed thereon. As is well known, the LED's and photodiodes respectively formed on each module enable data to be transmitted optically.

Advantageously, IrDA standards are ideally recommended

for high speed, short range, line of sight, point-to-point cordless data transfer, which are typically utilized in widespread commercial applications for personal computers, digital cameras, hand-held data collection devices, and the like. A more detailed outline of the standards and protocols designed and developed by the IrDA may be obtained from the Infrared Data Association based in Walnut Creek, California. Alternatively, such data may be obtained via the IrDA's website at <http://www.irda.org/standards/standards.asp>, the teachings of which are expressly incorporated herein by reference.

As will be appreciated by those skilled in the art, the use of standardized IrDA infrared communications schemes currently can enable data to be received and transmitted at rates up to four megabits per second (4 Mbps), which is substantially equivalent, if not faster, than conventional hard-wired systems. It is further contemplated that developments may soon be made which can support data transfer rates in excess of sixteen megabits per second (16 Mbps).

As will further be appreciated by those skilled in the art, likewise the infrared communications schemes developed by IrDA enable data to likewise be transmitted and received via an electrical interface. As will be appreciated by those skilled in the art, the electrical interface eliminates the need for line-of-sight alignment between LED and photodiodes particularly utilized in IrDA schemes, and likewise minimizes power consumption, which are known to be high in conventional IrDA schemes when transmitting signals via LED transmitters.

Because of the single wire connections utilized, the electrical interface implementation of IrDA allows a redundancy of connections which may thus be utilized to transmit the same data over multiple configurations, discussed more fully below. As such, due to the increased

probability or the chance of a correct transmission, the IrDA electrical interface implementation will have substantially increased reliability as compared to conventional single line hard-wire connections, which are
5 known to deteriorate and eventually become disconnected when subjected to high shock or vibrational activity.

Given the widespread availability of IrDA standards and protocols, it will be readily appreciated by those skilled in the art that a variety of infrared communication
10 schemes and the ability to electrically interface the same are already commercially available that may be implemented to facilitate the transfer of data amongst circuit cards. As such, one skilled in the art would easily be able to pick and choose which particular IrDA infrared
15 communication scheme may be appropriate for a given application.

Figure 3 depicts an example of how one such possible physical implementation of an IrDA infrared communications scheme may be implemented according to a preferred
20 embodiment of the present invention. As illustrated, first and second modules 40, 42 representing circuit boards, daughter cards, and the like, having dedicated pairs of digital transceiver 44, 46, and 48, 50 formed thereon that are electrically interfaced to one another such that each
25 respective digital transceiver pair 44, 46, and 48, 50 is operative to transmit and receive data from one module to another.

Fig. 4 depicts a second example of how an IrDA electrical interface may be implemented according to a
30 preferred embodiment of the present invention. As illustrated, first and second modules 60, 62 representing circuit boards are provided that each include two output-transmitting tri-stateable digital buffers, 64 and 68 on first module 60, and 74, 78 of second module 62, and two
35 input or digital receivers 66 and 70 on first module, and

72 and 76 on second module 62. The respective pairs of buffers and receivers 64, 66, and 68, 70 on first module 60 and 72, 74, and 76, 78 on second module 62, are arranged such that each respective output or transmitter element is electrically interconnected to a respective input or receiver element formed on the respective other module.

Control is invoked over each transmitter element pair 44, 50 or 64, 74 or 68, 78 such that they are prevented from transmitting simultaneously and thus contending for access to the same physical line. This control is implemented via the tri-state control input on each transmitter element. The media access control logic inherent to the IrDA protocol handles collision detection and retries on a given data line.

By so arranging the transmitting and receiving elements in the manner shown, at least two connections are established through which data may be transmitted and received between modules 60, 62. As such, to the extent a given connection between a respective transmitter element for example 64 on first module 60, to receiver 72 on second module 62 becomes disconnected or is otherwise not operative, there is yet a second link, defined by transmitter element 68 of first module 60 to receiver element 74 of second module 62, which can be utilized to transmit the same data. As will be appreciated by those skilled in the art, by providing such redundancy of interconnections, there is thus provided a higher degree of reliability insofar as interconnection between modules is not dependant upon a single connection. Likewise, because conventional hard-wiring systems already taken into account numerous conductors, typically formed as pin-type connections, is currently believed that the electrical interface implementation of IrDA would, at a minimum, be equivalent to prior art hard-wire connections, and thus would not be spatially inhibiting.

It is to be further understood that various additions, deletions, modifications and alterations may be made to the above-described embodiments without departing from the intended spirit and scope of the present invention.

- 5 Accordingly, it is intended that all such additions, deletions, modifications and alterations be included within the scope of the following claims.

CLAIMS

1. A shock-resistant system for operatively interconnecting modules within a computer system to enable data to be transmitted and received therebetween
5 comprising:

a. a first module having at least one tri-stateable digital transmitter element formed thereon for transmitting data from said first module, said first module having at least one digital receiver element
10 formed thereon for receiving data for said first module, said data transmitted and received by said first module substantially conforming to a standardized infrared communications scheme protocol;

b. a second module having at least one tri-stateable digital transmitter element formed thereon for transmitting data from said second module, said second module having at least one digital receiver element
15 formed thereon for receiving data for said second module, said data transmitted and received by said second module substantially conforming to said standardized infrared communications scheme protocol utilized by said first module; and

c. wherein said at least one transmitting element of said first module is electrically interfaced with said
25 at least one receiver element of said second module and said at least one transmitting element of said second module is electrically interfaced to said at least one receiver element of said first module such that said at least one transmitter element on said
30 first module is operative to transmit a signal to said at least one receiving element on said second module and said at least one transmitter element of said second module is operative to transmit a digital signal to said at least one receiver element of said
35 first module.

2. The system of Claim 1 wherein said infrared communications scheme protocol comprises a protocol developed by the Infrared Data Association.

3. The system of Claim 1 wherein said first and second
5 modules are housed within an enclosure.

4. The system of Claim 1 wherein said first and second modules are operative to run an embedded application.

5. The system of Claim 1 wherein said system comprises a multiplicity of modules wherein each respective one of said
10 multiplicity of modules has at least one dedicated transmitter element and receiver element formed thereon, each respective one of said multiplicity of modules being electrically interfaced to one another via said transmitter and receiver elements formed thereon such that said modules
15 are operative to transmit and receive data therebetween.

6. A method for operatively interconnecting modules within a computer to enable data to be transmitted and received therebetween comprising:

a. providing a first module having at least one
20 transmitter element and at least one receiver element formed thereon, said data transmitted and received by said first module substantially conforming to a standardized infrared communications scheme protocol;

b. providing a second module having at least one
25 transmitter element and at least one receiver element formed thereon, said data transmitted and received by said second module substantially conforming to a standardized infrared communications scheme or protocol;

c. electrically interfacing said first module with
30 said second module such that at least one transmitting element of said first module is electrically interfaced with said at least one receiving element of said second module and said at least one transmitting
35 element of said second module is electrically

interfaced to said at least one receiving element of
said first module such that said at least one
transmitter element on said first module is operative
to transmit a signal to said receiver on said first
5 module and said at least one transmitter element of
said second module is operative to transmit a signal
to said at least one receiver of said first module.

7. The method of Claim 8 wherein in steps a) and b), said
infrared communications scheme protocol comprises a
10 protocol developed by the Infrared Data Association.

8. The method of Claim 8 wherein in steps a) and b), said
first and second modules are housed within an enclosure.

9. The method of Claim 8 wherein in step c), said first
and second circuit cards are operatively coupled to run an
15 embedded application.

ABSTRACT OF THE DISCLOSURE

Infrared communications scheme for use in an embedded system. According to a preferred embodiment, the invention comprises the use of an infrared communications scheme, according to IrDA protocol, which is utilized to transmit and receive data via an electrical interface between circuit cards housed within an enclosed, embedded system. Preferably, each respective circuit card is provided with a digital tri-stateable transmitter element and a digital receiver to respectively transmit and receive data. The systems and methods of the present invention provide increased reliability than prior-art systems and methods.

\patents\NORTH391.app\031300

15 MAN:cal

004460-08342560

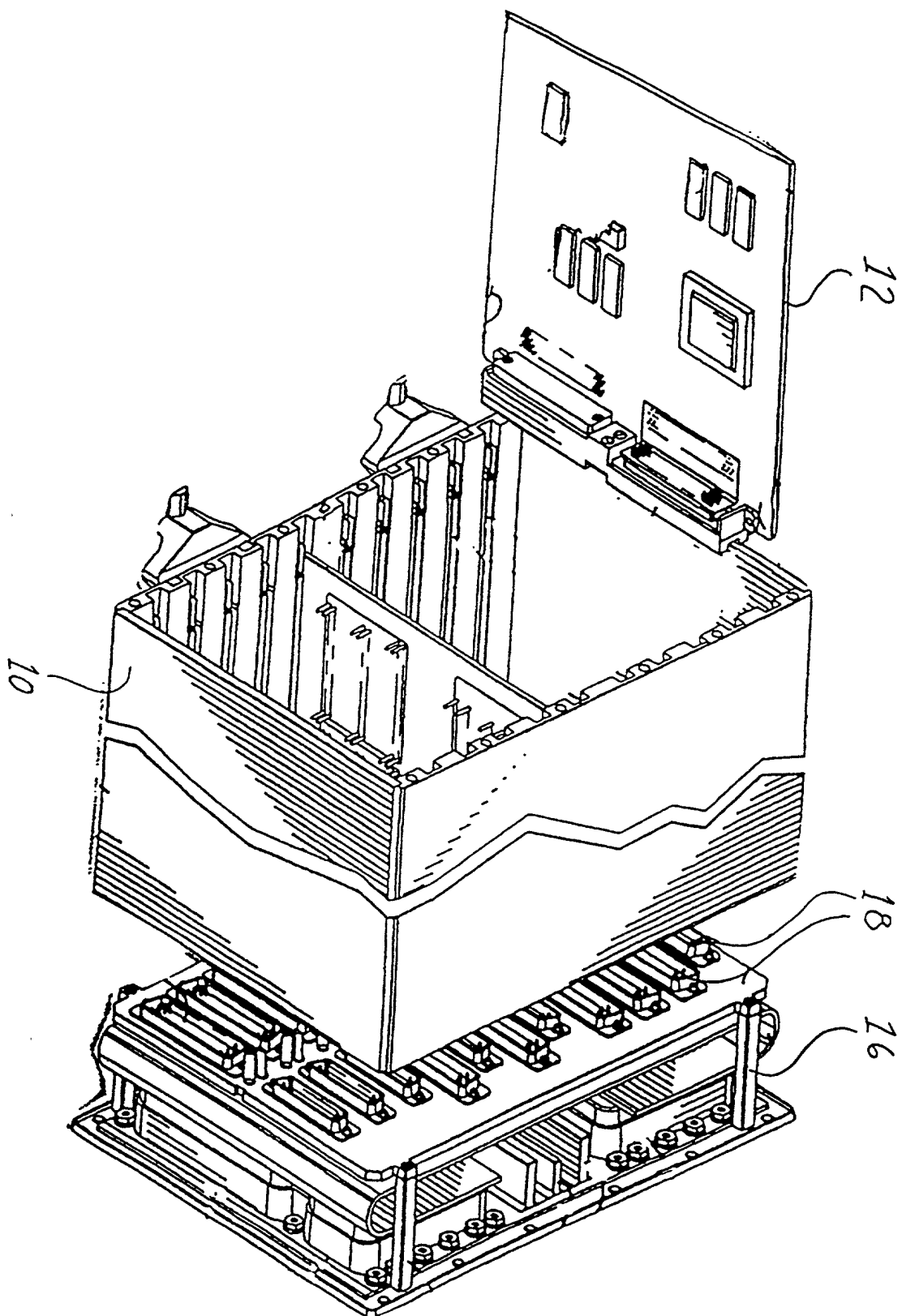
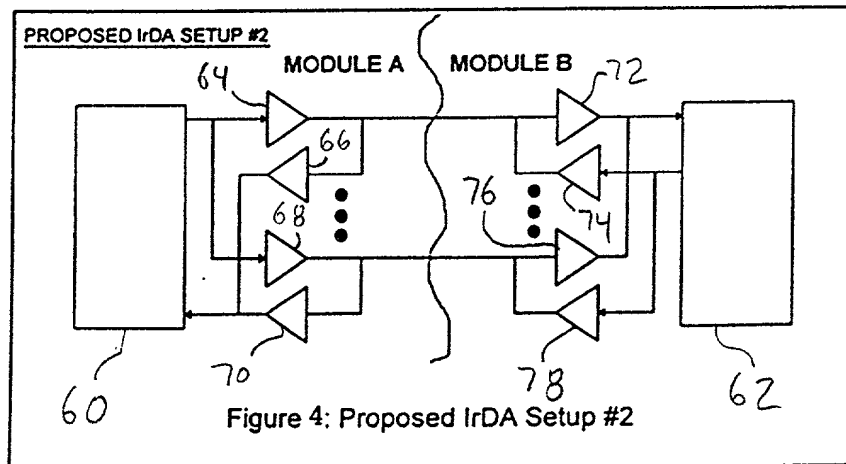
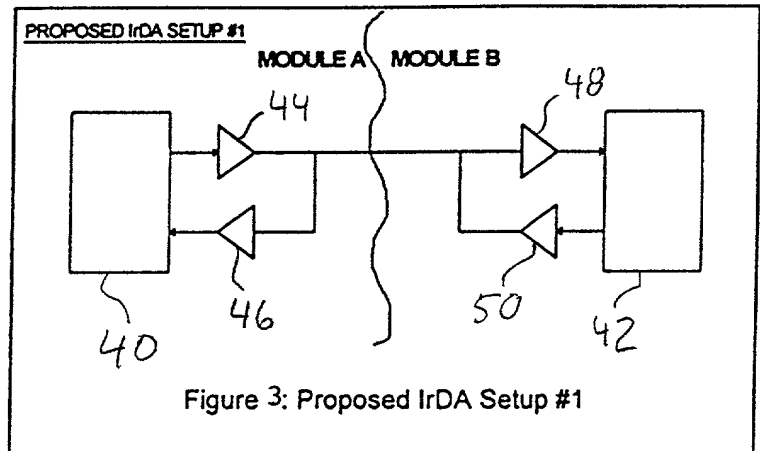
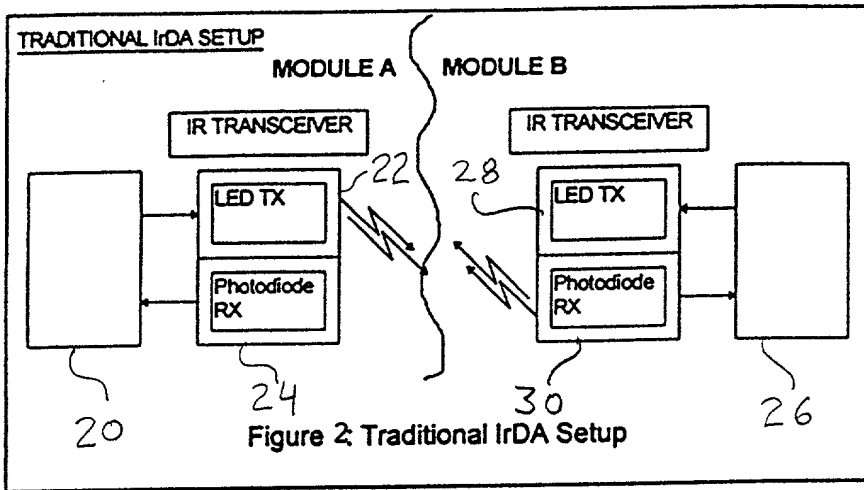


Fig. 1

[illegible]



Practitioner's Docket No. NORTH- 391A /A-2244**PATENT****COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
☐ design.
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☐ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

NOTE: See 37 C.F.R. § 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

- ☐ divisional.
☐ continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. § 1.53(b) (application filing requirements — nonprovisional application).

- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

SHOCK-RESISTANT BACKPLANE UTILIZING INFRARED COMMUNICATION SCHEME
WITH ELECTRICAL INTERFACE FOR EMBEDDED SYSTEMS

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b), or (c))

(a) ☒ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed;
or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☐ was filed on _____, as ☐ Serial No. 0 / _____
or ☐ _____
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. § 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(A) application number (consisting of the series code and the serial number, e.g., 08/123,456);

"(B) serial number and filing date;

"(C) attorney docket number which was on the specification as filed;

"(D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

M.P.E.P. § 601.01(a), 7th Ed.

(c) ☐ was described and claimed in PCT International Application No. _____, filed on _____ and as amended under PCT Article 19 on _____ (if any).

(Declaration and Power of Attorney [1-1]—page 2 of 7)

SUPPLEMENTAL DECLARATION (37 C.F.R. § 1.67(b))

(complete the following where a supplemental declaration is being submitted)

- ☐ I hereby declare that the subject matter of the
- ☐ attached amendment
 - ☐ amendment filed on _____

was part of my/our invention and was invented before the filing date of the original application, above-identified, for such invention.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. § 1.98.

PRIORITY CLAIM (35 U.S.C. §§ 119(a)–(d))

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119(a)–(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☒ no such applications have been filed.
- (e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

_____/_____
_____/_____
_____/_____

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. § 120**

- ☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

(Declaration and Power of Attorney [1-1]—page 4 of 7)

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

Terry J. Anderson, Esq., Reg. No. 24,271; Karl J. Hoch, Jr., Reg. No. 34,181;
Kit M. Stetina, Reg. No. 29,445; Bruce B. Brunda, Reg. No. 28,497;
Mark B. Garred, Reg. No. 34,823; William J. Brucker, Reg. No. 35,462;
Matthew A. Newboles, Reg. No. 36,224; Thomas C. Naber, Reg. No. 26,777;
Eric L. Tanezaki, Reg. No. 40,196;

(check the following item, if applicable)

- ☐ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

☒ Address

Terry J. Anderson, Esq.
NORTHROP GRUMMAN CORPORATION
1840 Century Park East
Los Angeles, CA 90067-2199

Terry J. Anderson, Esq.
(310) 332-5666

☐ Customer Number

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 CFR § 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, *inter alia*, identify each inventor and prohibits the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997,

Full name of sole or first inventor

Shannon M. Nelson
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)
Inventor's signature Shannon M. Nelson
Date March 20, 2000 Country of Citizenship U.S.A.
Residence 5122 North Natoma Avenue, Chicago, IL 60656
Post Office Address 5122 North Natoma Avenue, Chicago, IL 60656

Full name of second joint inventor, if any

Stuart J. Collar
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)
Inventor's signature _____
Date _____ Country of Citizenship U.S.A.
Residence 800 W. Vista Drive, Algonquin, IL 60102
Post Office Address 800 W. Vista Drive, Algonquin, IL 60102

Full name of third joint inventor, if any

Mark D. Hischke
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)
Inventor's signature _____
Date _____ Country of Citizenship U.S.A.
Residence 4 Walnut Lane, Algonquin, IL 60102
Post Office Address 4 Walnut Lane, Algonquin, IL 60102

(Declaration and Power of Attorney [1-1]—page 6 of 7)

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

- ☐ **Signature** for fourth and subsequent joint inventors. *Number of pages added* _____

* * *

- ☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____

* * *

- ☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* _____

* * *

- ☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added _____

* * *

- ☐ Authorization of practitioner(s) to accept and follow instructions from representative.

* * *

(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)

- ☒ This declaration ends with this page.

Practitioner's Docket No. NORTH- 391A /A-2244**PATENT****COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
- ☐ design.
- ☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☐ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

NOTE: See 37 C.F.R. § 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

- ☐ divisional.
- ☐ continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. § 1.53(b) (application filing requirements — nonprovisional application).

- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

SHOCK-RESISTANT BACKPLANE UTILIZING INFRARED COMMUNICATION SCHEME
WITH ELECTRICAL INTERFACE FOR EMBEDDED SYSTEMS

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b), or (c))

(a) ☒ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed;
or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☐ was filed on _____, as ☐ Serial No. 0 / _____
or ☐ _____
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. § 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(A) application number (consisting of the series code and the serial number, e.g., 08/123,456);

"(B) serial number and filing date;

"(C) attorney docket number which was on the specification as filed;

"(D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

M.P.E.P. § 601.01(a), 7th Ed.

(c) ☐ was described and claimed in PCT International Application No. _____, filed on _____ and as amended under PCT Article 19 on _____ (if any).

(Declaration and Power of Attorney [1-1]—page 2 of 7)

SUPPLEMENTAL DECLARATION (37 C.F.R. § 1.67(b))

(complete the following where a supplemental declaration is being submitted)

- ☐ I hereby declare that the subject matter of the
- ☐ attached amendment
- ☐ amendment filed on _____

was part of my/our invention and was invented before the filing date of the original application, above-identified, for such invention.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. § 1.98.

PRIORITY CLAIM (35 U.S.C. §§ 119(a)–(d))

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(f). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119(a)–(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☒ no such applications have been filed.
- (e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

_____/_____
_____/_____
_____/_____

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. § 120**

- ☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

(Declaration and Power of Attorney [1-1]—page 4 of 7)

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

Terry J. Anderson, Esq., Reg. No. 24,271; Karl J. Hoch, Jr., Reg. No. 34,181;
Kit M. Stetina, Reg. No. 29,445; Bruce B. Brunda, Reg. No. 28,497;
Mark B. Garred, Reg. No. 34,823; William J. Brucker, Reg. No. 35,462;
Matthew A. Newboles, Reg. No. 36,224; Thomas C. Naber, Reg. No. 26,777;
Eric L. Tanezaki, Reg. No. 40,196;

(check the following item, if applicable)

- ☐ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

☒ Address

Terry J. Anderson, Esq.
NORTHROP GRUMMAN CORPORATION
1840 Century Park East
Los Angeles, CA 90067-2199

Terry J. Anderson, Esq.
(310) 332-5666

☐ Customer Number

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 CFR § 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, inter alia, identify each inventor and prohibits the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997,

Full name of sole or first inventor

Shannon

M.

Nelson

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence 5122 North Natoma Avenue, Chicago, IL 60656

Post Office Address 5122 North Natoma Avenue, Chicago, IL 60656

Full name of second joint inventor, if any

Stuart

J.

Collar

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature Stuart J. Collar

Date 3-20-00 Country of Citizenship U.S.A.

Residence 800 W. Vista Drive, Algonquin, IL 60102

Post Office Address 800 W. Vista Drive, Algonquin, IL 60102

Full name of third joint inventor, if any

Mark

D.

Hischke

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence 4 Walnut Lane, Algonquin, IL 60102

Post Office Address 4 Walnut Lane, Algonquin, IL 60102

(Declaration and Power of Attorney [1-1]—page 6 of 7)

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

- ☐ **Signature** for fourth and subsequent joint inventors. *Number of pages added* _____

* * *

- ☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____

* * *

- ☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* _____

* * *

- ☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added _____

* * *

- ☐ Authorization of practitioner(s) to accept and follow instructions from representative.

* * *

(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)

- ☒ This declaration ends with this page.

Practitioner's Docket No. NORTH- 391A /A-2244**PATENT****COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
☐ design.
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☐ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

NOTE: See 37 C.F.R. § 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

- ☐ divisional.
☐ continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. § 1.53(b) (application filing requirements — nonprovisional application).

- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

SHOCK-RESISTANT BACKPLANE UTILIZING INFRARED COMMUNICATION SCHEME
WITH ELECTRICAL INTERFACE FOR EMBEDDED SYSTEMS

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b), or (c))

(a) ☒ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed;
or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☐ was filed on _____, as ☐ Serial No. 0 / _____
or ☐ _____
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. § 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(A) application number (consisting of the series code and the serial number, e.g., 08/123,456);

"(B) serial number and filing date;

"(C) attorney docket number which was on the specification as filed;

"(D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

M.P.E.P. § 601.01(a), 7th Ed.

(c) ☐ was described and claimed in PCT International Application No. _____, filed on _____ and as amended under PCT Article 19 on _____ (if any).

(Declaration and Power of Attorney [1-1]—page 2 of 7)

SUPPLEMENTAL DECLARATION (37 C.F.R. § 1.67(b))*(complete the following where a supplemental declaration is being submitted)*

- ☐ I hereby declare that the subject matter of the
- ☐ attached amendment
- ☐ amendment filed on _____

was part of my/our invention and was invented before the filing date of the original application, above-identified, for such invention.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. § 1.98.

PRIORITY CLAIM (35 U.S.C. §§ 119(a)-(d))

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☒ no such applications have been filed.
- (e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

_____/_____
_____/_____
_____/_____

CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. § 120

- ☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

(Declaration and Power of Attorney [1-1]—page 4 of 7)

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

Terry J. Anderson, Esq., Reg. No. 24,271; Karl J. Hoch, Jr., Reg. No. 34,181;
 Kit M. Stetina, Reg. No. 29,445; Bruce B. Brunda, Reg. No. 28,497;
 Mark B. Garred, Reg. No. 34,823; William J. Brucker, Reg. No. 35,462;
 Matthew A. Newboles, Reg. No. 36,224; Thomas C. Naber, Reg. No. 26,777;
 Eric L. Tanezaki, Reg. No. 40,196;

(check the following item, if applicable)

- ☐ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

☒ Address

Terry J. Anderson, Esq.
 NORTHROP GRUMMAN CORPORATION
 1840 Century Park East
 Los Angeles, CA 90067-2199

Terry J. Anderson, Esq.
 (310) 332-5666

☐ Customer Number --

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 CFR § 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, inter alia, identify each inventor and prohibits the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997,

Full name of sole or first inventor

Shannon

M.

Nelson

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence 5122 North Natoma Avenue, Chicago, IL 60656

Post Office Address 5122 North Natoma Avenue, Chicago, IL 60656

Full name of second joint inventor, if any

Stuart

J.

Collar

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence 800 W. Vista Drive, Algonquin, IL 60102

Post Office Address 800 W. Vista Drive, Algonquin, IL 60102

Full name of third joint inventor, if any

Mark

D.

Hischke

(GIVEN NAME)

(MIDDLE INITIAL OR NAME)

FAMILY (OR LAST NAME)

Inventor's signature Mark D. Hischke

Date 3/20/2000 Country of Citizenship U.S.A.

Residence 4 Walnut Lane, Algonquin, IL 60102

Post Office Address 4 Walnut Lane, Algonquin, IL 60102

(Declaration and Power of Attorney [1-1]—page 6 of 7)

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

- ☐ **Signature** for fourth and subsequent joint inventors. *Number of pages added* _____

* * *

- ☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____

* * *

- ☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* _____

* * *

- ☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added _____

* * *

- ☐ Authorization of practitioner(s) to accept and follow instructions from representative.

* * *

(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)

- ☒ This declaration ends with this page.